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中国橙衣属和果衣属地衣的新记录种

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摘要: 通过对采自云南省景东彝族自治县无量山地衣标本的研究, 发现了橙衣属的一个中国新纪录 *Caloplaca indica* (三室类型孢子) 和果衣属的一个中国新纪录 *Ramboldia haematites*。在对实验室标本的整理过程中, 发现 *Ramboldia haematites* 在福建省和广西省同样存在。该文详细描述了其形态学、解剖学和化学方面的特征, 并且提供了显微结构照片。本研究丰富了云南省、福建省和广西省地衣的物种多样性, 为橙衣属和果衣属地衣分类学研究提供基础数据和可靠资料。所用标本存放在山东师范大学植物标本室 (SDNU)。

关键词: 分类学, 地衣型真菌, 东亚

New records of *Caloplaca* and *Ramboldia* from China

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Abstract: Lichen specimens collected from Wuliang Mountain, Jingdong Yi Autonomous County, Yunnan, included two species *Caloplaca indica* and *Ramboldia haematites* which were found for the first time in China. Subsequently, *R. haematites* has also been discovered in Fujian and Guangxi. A detailed description of the morphology, anatomy and chemistry of these species are given in this paper. This study enriched the species diversity of lichens in Yunnan, Fujian and Guangxi provinces, and provided basic data and reliable data for the taxonomic study of lichens in *Caloplaca* and *Ramboldia*. The specimens examined are deposited in the Herbarium of Shandong Normal University (SDNU).

Key words: taxonomy, lichenized fungi, East Asia

Introduction

The Jingdong Yi Autonomous County is located in Southwestern Yunnan. It has a subtropical monsoon climate and a variation from 795 to 3 371 m above sea level. The annual average relative humidity is 77%, and the annual average rainfall is 1 086.7 mm.

Caloplaca Th. Fr. s. lat. (*Teloschistaceae*, *Teloschistales*, *Lecanoromycetes*, *Ascomycota*) is a genus characterized by a crustose or placodioid thallus. There are about 350 species worldwide (Lücking, 2016). The species usually have orange, K+ purple (anthraquinones present) apothecia, but the most important delimitation is the presence of polarbilocular ascospores. In 1881, Müller placed a group of species bearing plurilocular ascospores (3–6 locules) under *Caloplaca* section *Triophthalmidium*. This section is mostly distributed in tropical and subtropical regions of the world and is mainly corticolous, rarely saxicolous (Smith, 2009; Joshi et al., 2014).

The genus *Ramboldia* (*Ramboldiaceae*, *Lecanorales*, *Lecanoromycetes*, *Ascomycota*) was established by Kantvilas & Elix (1994). This genus is characterized by a crustose thallus with

leciodeoid apothecia, *Lecanora*-type asci, anastomosing paraphyses, and simple and persistently hyaline ascospores (Elix, 2004; Kantvilas et al., 1994, 2007). Some species have orange to red-pigmented apothecia due to the presence of russulone and related anthraquinones (Kantvilas et al., 1994; Kalb et al., 2008). *Ramboldia* contains about 30 species worldwide (Lücking, 2016). In China only four *Ramboldia* species, *R. cinnabarina*, *R. elabens*, *R. heterocarpa* and *R. russula*, have been reported (Zahlbruckner, 1930; Abdulla & Wu, 1998; Aptroot & Sparrius, 2003; Obermayer 2004).

The purpose of our study is to enrich knowledge of the species composition of *Caloplaca* and *Ramboldia* in China, contributing fundamental data and reliable results for the preparation of a Lichen Flora of China. In this study, two species of *Caloplaca indica* and *Ramboldia haematites* are reported for the first time from China, and *Ramboldia* is reported for the first time from Fujian and Guangxi.

1. Materials & methods

The specimens studied were deposited in SDNU (Lichen Section of Botanical Herbarium, Shandong Normal University). The morphological and anatomical characters of the specimens were examined under a stereo-microscope (Olympus SZ) and a polarizing microscope (Olympus CX21). Thallus and medulla were spot-tested with K (a 10% aqueous solution of potassium hydroxide), C (a saturated solution of aqueous sodium hypochlorite), I (Lugol's iodine) and P (a saturated solution of p-phenylenediamine in 95% ethyl alcohol). The lichen substances were identified using thin layer chromatography (TLC) with solvent system C (Orange et al., 2010). Photos of the lichens were taken under Olympus SZX16 and BX61 with DP72.

2. Taxonomic descriptions

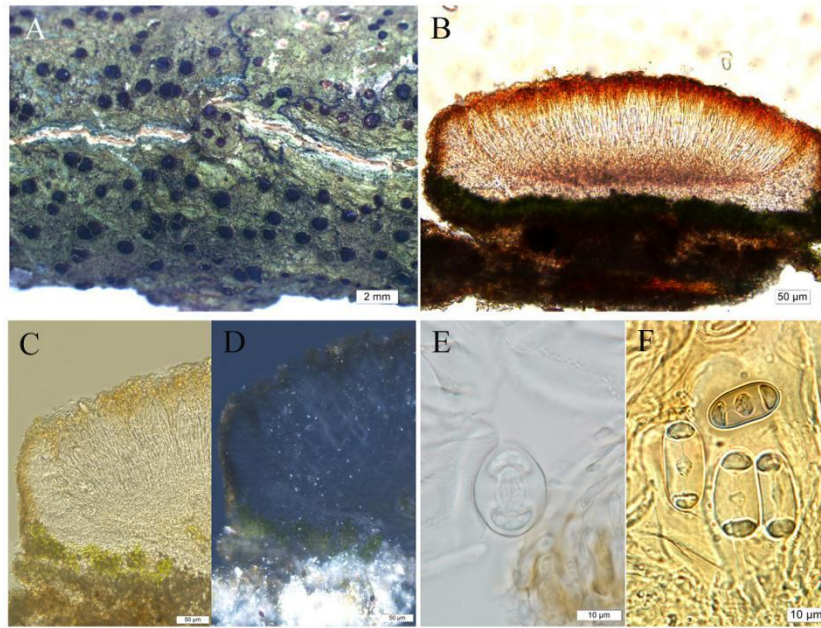
Caloplaca indica Y. Joshi, Jagad. Ram & G.P. Sinha, in Joshi, Jagadeesh, Singh & Sinha, National Academy Science Letters 37(6): 517 (2014) **FIG. 1**

MORPHOLOGY — Thallus crustose, corticolous, whitish grey to greenish grey. Photobiont layer continuous. Prothallus ± present, forming a black line at borders. Apothecia zeorine, 0.25–1 mm diam.; disc brown, flat; proper margin thin, flush to raised above the level of disc, concolorous or slightly darker than disc; thalline margin thin, smooth to crenulate, concolorous with thallus. Epithecium yellowish brown, 25–32.5 µm high, K–; hymenium colorless, 75–100 µm high, oil droplets present; hypothecium colorless, oil droplets ± present. Asci clavate, 50–57.5 × 15–20 µm, *Teloschistes*-type, 8-spored. Ascospores hyaline, bi- to trilocular, slightly constricted in the centre, all locules of ± equal size, 20–27.5 × 10–13 µm. Pycnidia not seen. On bark.¹

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Note: A. Thallus and prothallus (black); B, C. Apothecium section; D. Amphithecium (no crystals); E. Ascospores (bilocular). F. Ascospores (trilocular). Scale A = 2 mm; Scale B = 50 μ m; Scale C = 10 μ m; Scale D = 10 μ m.

Fig. 1 *Caloplaca indica* (SDNU 20170667)

CHEMISTRY — Thallus and medulla K–, C–, KC–, Pd–, UV+ yellowish orange. Apothecia K–, C–, KC–, Pd–. Lichexanthone detected by TLC.

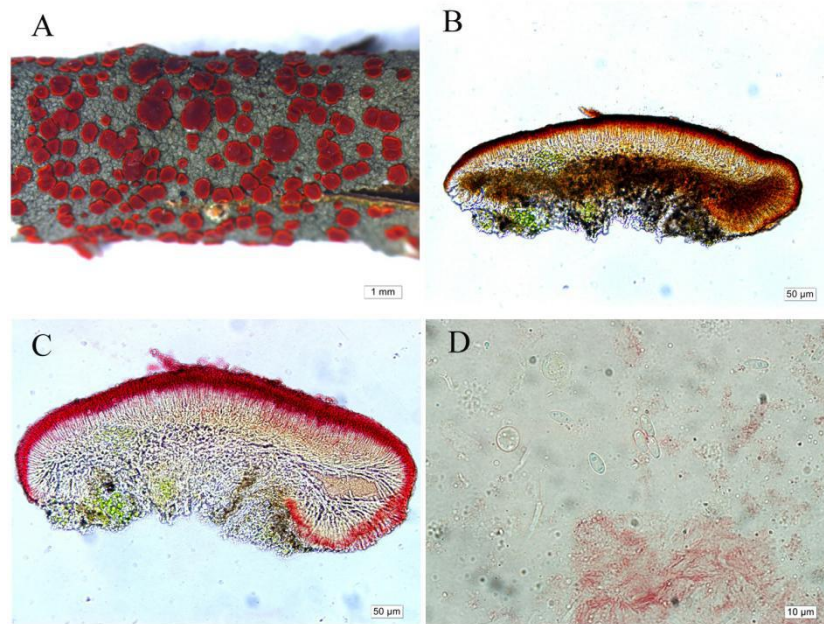
DISTRIBUTION — The species is reported so far only from Eastern Himalaya (Joshi et al., 2014). New to China.

SPECIMENS EXAMINED: **China. Yunnan:** Jingdong, Wuliangshan, alt. 2 200–2 300 m, on bark, 7 Aug. 2017, R. Tang, M. J. Sun, S. K. Yan & J. M. Fu 20170874, 20170667 (SDNU).

COMMENTS — *Caloplaca indica* is mainly characterized by the greyish UV+ yellowish orange (lichexanthone present) thallus, zeorine apothecia, bi- to trilocular ascospores. In terms of ascospore morphology, the species resembles *Caloplaca crocea* (Kremp.) Hafellner & Poelt and *Caloplaca trilocularis* Zahlbr. *Caloplaca crocea* differs mainly in having yellow to yellowish orange apothecia. *Caloplaca trilocularis* differs mainly in having crystals in amphithecium and a thick thalline margin (Joshi et al., 2014).

***Ramboldia haematites* (Fée) Kalb, Lumbsch & Elix, Nova Hedwigia 86 (1–2): 33 (2008) Fig. 2**

MORPHOLOGY — Thallus grey or greyish-green, frequently continuous or smoothly rimose, 90–150 μ m thick. No vegetative propagules present. Prothallus not seen. Apothecia adnate, roughly round, flat, 0.15–1 mm diam; disc orange-red, pruina absent; exciple red, K+ purple; epithecium 10–14 μ m thick, reddish; hymenium 35–45 μ m thick, colourless; subhymenium 20–35 μ m thick, colorless; hypothecium 55–100 μ m thick, pale brown. Asci clavate, 37.5–45 \times 10–15 μ m, Lecanora-type, 8-spored; Ascospores colourless, simple, ellipsoid, 8–10 \times 3–4 μ m. Pycnidia not seen. On bark.



Note: **A.** Thallus and apothecia; **B.** Apothecium section; **C.** Apothecium section (showing epiphysemenium and exiple K⁺ reaction); **D.** Simple ascospores. Scale A = 1 mm; Scale B = 50 μm; Scale C = 50 μm; Scale D = 10 μm.

Fig. 2 *Ramboldia haematites* (SDNU 20170847)

CHEMISTRY — Thallus and medulla K⁺ yellow to red or K[−], C[−], UV⁺ yellow. Lichexanthone, secalonic acid A (±), norstictic acid and russulone detected by TLC.

DISTRIBUTION — This species is known from North America, Africa, Australia, New Caledonia (Kalb et al. 2008; Elix 2009) and Japan (Yamamoto et al. 2013). New to China.

SPECIMENS EXAMINED: **China. Yunnan:** Jingdong, Wuliangshan, alt. 2 200 m, on bark, 7 Aug. 2017, R. Tang, M.J. Sun, S.K. Yan & J. M. Fu 20170679, 20170847 (SDNU). **Guangxi:** Baise, Cenwanglaoshan, alt. 1 800 m, on bark, 24 Feb. 2011, L. Li 20111740 (SDNU). **Fujian:** Longyan, Huanlianyu, alt. 1 400 m, on bark, 29 Oct. 2010, D. F. Jiang 20105509 (SDNU).

COMMENTS — *Ramboldia haematites* is morphologically similar to *Ramboldia russula* (Ach.) Kalb, Lumbsch & Elix, but differs by having norstictic acid (not fumarprotocetraric acid) in the apothecia (Kantvilas et al. 1994; Elix 2004; Kantvilas et al. 2007; Kalb et al. 2009; Gumboski 2014). Our specimens are very similar to the original description of *R. haematites* (Elix 2009), except that we failed to detect any connorstictic acid, which was considered one of the taxonomically important characteristics for the species by Kalb et al. (2008).

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